

THE ROLE OF PLANT AGRICULTURAL PRACTICES ON DEVELOPMENT OF ANTIMICROBIAL
RESISTANT FUNGI AFFECTING HUMAN HEALTH

Tuesday, June 21 2022
10:00 AM – 2:00 PM ET
Virtual

Bridging the Two Worlds: Fungal Pathogens in Plant and Human Health

10:00 AM **Welcome Remarks, Workshop Overview, and Goals**

- Paige Waterman, *workshop co-chair*

Commented [LJ1]: Note to make special efforts in reaching to the public health and human health/medicine side, bringing them in as attendees to the workshop for awareness and to learn about this issue

10:10 AM **Opening Panel**

Tom Chiller, *moderator*

- Panelist 1: antifungal drug use in human medicine, including brief history and overview of fungal diseases of concern in modern medicine and highlight importance of antifungal drugs in patient care
 - Arturo Casadevall, Johns Hopkins University Bloomberg School of Public Health
 - Alt: Matthew Fisher, Imperial College London
- Panelist 2: provide context of fungicide uses in plant agriculture (vs other uses), overview of the types of use, and the role of FRAC in usage stewardship; if possible, include a brief history of fungicide development and estimated magnitude of use in agriculture (plant vs animal) for context
 - Gilberto Olaya (NAFRAC; Syngenta) or Andreas Goertz (FRAC; Bayer) – someone from USDA?
- Panelist 3: fungicide uses outside of plant crops, including horticulture and wood preservation
 - Thies Marten Heick or Lise Nistrup Joergensen
- Panel discussion to cover:
 - Overview of the issue of resistance development against fungicides and antifungal drugs, define overlap in fungicide and antifungal drug arsenal
 - Distinguish between fungal pathogens that pose a hazard to plants vs to humans, and discuss risk factors that could lead to human health concerns
 - Identify outstanding questions and concerns from each side regarding use and pathogen resistance, human health and safety, food security, and current chemical/drug

Most on the human side likely don't know about extension school work and relationships with agriculture practices

Infectious Diseases Society of America (IDSA) is a key professional society that we can reach out to
American Society for Microbiology (ASM) is another

Commented [LJ2]: [HYPERLINK
"https://pure.au.dk/portal/en/persons/thies-marten-heick(2abc938c-3242-485c-ab4b-4f65f75581bf).html"]

Commented [LJ3]: [HYPERLINK
"https://pure.au.dk/portal/en/persons/lise-nistrup-joergensen(492dbc53-6cbe-461e-a651-1f05c7f2bd9).html"]

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development pipeline

15 min break

11:30 AM **Fungal Diseases, Antifungal Resistance, and Human Health**

Need moderator – Paige?

- Overview of the impact of invasive fungal diseases and antifungal drug resistance on human health: types of severe fungal diseases, national and global fungal disease burden; *focusing on expansion of populations at risk*, including COVID-19 patients; critical importance of antifungal drugs
 - **Barbara Alexander, Duke University**
 - Alt: Peter Pappas, University of Alabama Birmingham; or others from MSG/IDSA
- Overview of aspergillosis, particularly in patients who are immunosuppressed or critically ill: current treatment options (with emphasis on role of azoles for invasive aspergillosis), emergence of COVID-19 associated pulmonary aspergillosis, mechanisms of antifungal resistance (patient route vs environmental), discussion of global rise in antifungal drug-resistant Af infections
 - **David Denning, GAFFI; University of Manchester, retired**
- Overview of drug-resistant invasive *Candida* infections, including *C. auris*, *C. tropicalis*, and others
 - **Brendan Jackson, US CDC**
- Current research in understanding pathogenesis and host immunity toward developing treatment options
 - **Michail Lionakis, NIH/NIAID**
 - Alt: Andy Shorr or David Andes (University of Wisconsin)

12:30 PM **Fungicide Resistance in Plant Protection Use**

Marin Talbot Brewer, *moderator*

- Genetics and mechanisms of fungicide resistance, and current evidence base associating environmental fungi and antifungal resistance (triazoles)
 - Johanna Rhodes or Matt Fisher, Imperial College London
- Current knowledge on practices that influence AMR in plant use environments, including knowledge gaps

Commented [LJ4]: For speaker prep: we will ask to include mention of different uses and different policies on Day 1 as an introduction, set up for Day 2's deeper discussion on surveillance

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- Sijmen E. Schoustra, Wageningen University ([
HYPERLINK
"https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6590754/"])
- Alt: Kevin Doughty, Bayer ([HYPERLINK
"https://www.mdpi.com/2076-2607/9/12/2439"])
- Climate change and fungal pathogen evolution, and implications
for antimicrobial use and resistance development
 - Dee A. Carter, University of Sydney
 - Alt: Ilse Delcour, Ghent University? (can't find contact
info)

1:15 PM **Roundtable Discussion** with above speakers

1:55 PM **Summary** and Adjourn

Commented [AL5]: Human health focused, but these papers show a good connection between climate change and antifungal resistance
<https://www.sciencedirect.com/science/article/abs/pii/S0963996914006309#!>

Also human health, climate change, and antifungal resistance: Dee A. Carter, [HYPERLINK
"mailto:dee.carter@sydney.edu.au"]
<https://journals.plos.org/plospathogens/article?id=10.1371/journal.ppat.1009503>

Commented [LJ6]: Note to highlight connections between human, plant, and environmental health in fungal AMR

THE ROLE OF PLANT AGRICULTURAL PRACTICES ON DEVELOPMENT OF ANTIMICROBIAL
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Wednesday, June 22 2022
10:00 AM – 2:00 PM ET
Virtual

Effects of Fungicide Use in Plants on Humans and the Environment

10:00 AM **Welcome Remarks, Review of Day 1**

- *Need moderator, Jeff LeJeune?*

10:05 AM **Role of Fungicide Use in Food Safety and Security**

- Economics of fungicide use in different crops and yield
 - Corn and foliar crops: Kiersten Wise or Daren Mueller
- Case example: mycotoxin contamination and food safety
 - Pierce Paul, The Ohio State University
- Outcomes of fungicide use and addressing the challenges of AMR (*moderator provide this summary*)

Commented [L77]: Moved some components around on Day 1 and frame this to strengthen connection to the workshop task through the One Health lens of how does fungicide use and the challenge of AMR in fungal pathogens also impact human health through food security and food safety

10:35 AM **Dimensions of Fungicide Regulations, Use Management, and Risk Assessment**

Lynn Goldman, *moderator*

- Documentation of azole fungicide use in plants
 - High-Income Countries: Jeff LeJeune
 - Low- and Middle-Income Countries: Phil Taylor
- Registration review and health threats assessment of fungicides
 - US: Carl Bradley, APS Liaison to EPA
 - International: **Patience Browne, Principal Administrator, Hazard Assessment and Pesticides Programmes, Environmental Directorate, OECD**
- Environmental exposure to humans and considerations for evaluating indirect or long-term health effects
 - Occupational health: (tying together exposure for ag workers, exposure to residential areas due to encroachment, and environmental “hot spots”)

15 min break

11:55 PM **Innovations in AMR Surveillance Tools and Technologies**

- Environmental surveillance and management: water sampling for triazoles or resistant fungi

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- Titus A. M. Msagati, The Nelson Mandela African Institution of Science and Technology ([[HYPERLINK "mailto:msagatam@unisa.ac.za"](mailto:msagatam@unisa.ac.za)])
- Alt: Bhiekie B. Mamba, University of South Africa? ([[HYPERLINK "https://pubmed.ncbi.nlm.nih.gov/32914303/"](https://pubmed.ncbi.nlm.nih.gov/32914303/)])
- Innovation in data collection/technology/tools for surveillance and mitigation
 - Compost Council, horticulture/flower (e.g., bulbs, flower farms in Washington and Oregon states) on their industry practices and surveillance, efforts to monitor and minimize spore spread at different stages of production
 - Bart Fraaije, NIAB
- Crop and environment simulation tools
 - Brian Bailey, UC Davis
- Sampling strategies, interpretation of sampling outcomes, and evaluation of surveillance and management technologies
 - [[HYPERLINK "https://scholar.google.com/citations?hl=en&user=8dMWriAAA-AAJ&view_op=list_works&sortby=pubdate"](https://scholar.google.com/citations?hl=en&user=8dMWriAAA-AAJ&view_op=list_works&sortby=pubdate)], University of Florida

Commented [LJ8]: It looks like he leads work on azole resistance epidemiology in the field, and assay development for pathogen species identification. Is he suitable for this discussion on data collection and new tools?

Commented [AL9]: Alternately, Walt could probably give an overview of these issues in the discussion of targeted approaches and localized risk factors.

1:15 PM **Discussion**

1:55 PM **Summary and Adjourn**

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Monday, June 27 2022
10:00 AM – 2:00 PM ET
Hybrid

Commented [LJ10]: Day 3 – really getting to the point of taking a more targeted approach, the gaps and challenges for this, and viable next steps

Mitigation Strategies for Fungicide/Antifungal Resistance

8:00 AM **Welcome in-person participants**

In-person networking and breakfast

10:00 AM **Welcome virtual attendees; Review of workshop thus far**

- Paige Waterman (workshop co-chair), (first session moderator), and (second session moderator)?
- Introduce hypothetical scenario here?

Commented [LJ11]: Include discussion of other fungal pathogens important for human health and potential considerations for other emerging fungal pathogens

10:15 AM **One Health Approach to AMR and Pathogen Surveillance**

Paul Verweij (Radboud University), *possibly moderator?*

- The necessity and benefits of taking a One Health approach in AMR surveillance and mitigation measures: Can reinforce and define what the hazards are (e.g., what pathogens are we talking about in plants vs in humans, where are these pathogens and how are they managed, what are the risks to human health and how defined are these risks)
 - Jianping Xu, McMaster University; or Florent Morio, Nantes University Hospital
- Genomic surveillance and epidemiology; data toward characterizing the source of antimicrobial resistance development
 - Marin Talbot Brewer, University of Georgia
- Diagnostics and resistance testing capabilities in local and national levels: health care systems and agricultural systems
 - Bart Fraaije, NIAB
 - Michael A. Pfaller, University of Iowa, emeritus
 - Neil McRoberts, National Plant Diagnostic Network (*invite to workshop but not as speaker?*)
 - Alt: Agustín Resendiz-Sharpe or Anuradha Chowdhary or someone from the ISHAM working groups
- One Health approach to AMR and pathogen surveillance at the

Commented [AS12]: Are we speaking here of fungicide use (surveillance or AMR surveillance)? Surveillance of fungicide use is a really broad topic and perhaps not relevant. Consider moving the second bullet up into the previous session

Commented [AL13]: [HYPERLINK "https://pubmed.ncbi.nlm.nih.gov/34279697/"]
[HYPERLINK "https://pubmed.ncbi.nlm.nih.gov/33568450/"]

Commented [LJ14]: [HYPERLINK "https://onlinelibrary.wiley.com/doi/abs/10.1111/myc.13404"]

Commented [LJ15]: Recent PhD defense (2021): [HYPERLINK "https://www.kuleuven.be/onderzoek/portaal/"]
[HYPERLINK "https://www.mdpi.com/2309-608X/7/4/292/htm"]

Commented [LJ16]: [HYPERLINK "https://www.isham.org/working-groups/aspergillus-resistance-surveillance"]

[HYPERLINK "https://www.vpci.org.in/pageLevel.php?id=11&cat=implinks&subid=47&subcat=implinks_sublinks_sublinks"]

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international level

- Alejandro Dorado-García, FAO InFARM System
- Don Prater (US FDA; chair of the Code of Practice to Minimize and Contain Foodborne AMR)

30 min break

12:15 PM Antifungal Drug Development and Stewardship in Health Care

- New antifungal drugs in development with different modes of action
 - John Perfect (Duke University; IDSA Mycoses Study Group) or David Andes (University of Wisconsin; IDSA Mycoses Study Group)
- Incentives and market for drug development, and global access
 - Jennie Hood, Global AMR Hub

1:00 PM Integrated Disease Management: panel discussion

- Precision application technologies and communication with growers and other stakeholders
 - Melanie Ivey, The Ohio State University
- Economics analysis or and barriers to IPM adoption
 - George Norton, Virginia Tech, retired; alt: Jeff Ahwang, Virginia Tech
- Current research toward targeted approaches and considering localized risk factors
 - Walt Mahaffee, USDA

Commented [M517]: I suggest here Melanie Ivey, who could address modeling and predictive strategies to reduce pesticide use, including the intelligent sprayer. She is an extension specialist and could also tell about how we provide IPM info to stakeholders. Melanie also leads a new USDA NIFA AFRI AMR project on surveillance ofazole resistance in fungi.

1:50 PM Summary of Workshop

2:00 PM Adjourn for Poster Session

30 min break then poster session
(need staff for poster session: FMT +/- borrow someone)